

## Working party report on cardiac rehabilitation

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### 1 Introduction

1.1 Cardiac rehabilitation can be defined as the process by which patients are restored to and are maintained in their optimal physiological, vocational, and social status. It is a multidisciplinary approach to improve short-term recovery and to promote long-term changes in lifestyle which correct adverse risk factors.

1.2 Ischaemic heart disease remains the commonest cause of cardiac death in western societies and the highest rates in the world are found in parts of the British Isles. In most district general hospitals myocardial infarction and other coronary syndromes are the largest single diagnostic category for patients admitted to general medical beds. For a population of 200 000 this usually means that between 200 and 600 patients per year would be suitable for cardiac rehabilitation depending on the local prevalence of disease. In addition increasing numbers of patients are being treated by coronary artery bypass grafting or angioplasty. Two thirds of these people could be expected to resume their normal daily duties either at work or at home.

1.3 The first cardiac rehabilitation service was set up in the United Kingdom over 20 years ago, but despite the large numbers of patients who might benefit, only a few have facilities available to them now; this is largely because of a divergence of opinion among cardiologists and physicians about the physical and psychological benefits of rehabilitation.

### 2 Development worldwide

2.1 The finding in the 1950s that coronary patients have responses to exercise that are similar to normal, but modified by deconditioning, led to the use of physical training to aid postinfarction recovery.<sup>1</sup> Israel was the cradle of the large scale rehabilitation effort.<sup>2-4</sup> As early as 1955 Gottheiner<sup>4</sup> stated his approach to training coronary patients and by 1968 had experience of over 1000 patients who had training for at least five years. At the same time Hellerstein and Ford (1957)<sup>5</sup> in Cleveland, Ohio, produced guidelines for cardiac rehabilitation at exercise centres: many of these have not been improved upon since.

2.2 During the 1960s and 1970s coronary rehabilitation spread through North America<sup>6,7</sup> and Europe<sup>8,9</sup> and has now become an established treatment for postinfarction patients in many countries. The trend has moved away

from long-term supervised exercise to short courses of physical training after the acute illness with encouragement to patients to continue exercising unsupervised thereafter.

2.3 There is still much disparity between centres in the structure of these programmes; this was partly responsible for the ending of the huge World Health Organisation multicentre controlled trial of postinfarction rehabilitation<sup>10</sup> before any firm conclusions could be reached.

2.4 Even now cardiac rehabilitation means very different things in different countries. In the United States and parts of Europe rehabilitation programmes have a large capital investment which is little less than for a full physiological laboratory and are able to undertake sophisticated objective measures of a patient's progress. In Germany and Italy there are well established inpatient programmes lasting several weeks. In the United Kingdom, by contrast, most programmes are outpatient based, concentrate on patients in the first few months after myocardial infarct or cardiac surgery, and do not attempt to undertake long-term training.

### 3 Role of exercise

3.1 For many years there has been interest in the relation between coronary heart disease and physical activity. Epidemiological research began almost 40 years ago,<sup>11</sup> but it was not until 1984 that evidence became available that suggested that athleticism reduces the incidence of coronary heart disease.<sup>12</sup> A recent prospective study showed that a low level of physical fitness is an important risk factor in both men and women and that high levels seem to delay all-cause mortality and specifically to reduce mortality caused by cardiovascular disease and cancer.<sup>13</sup>

3.2 In patients with established cardiac disease the evidence for improved survival with rehabilitation is increasing. An overview of 22 randomised trials of exercise based rehabilitation after myocardial infarction in 4554 patients showed a 20% reduction in overall mortality. This was reflected in a decreased risk of cardiovascular mortality and fatal reinfarction for at least three years and a reduction in sudden death for at least a year after myocardial infarction (fig 1).<sup>14</sup> A similar meta-analysis of 10 trials concluded that comprehensive cardiac rehabilitation had a beneficial effect on mortality, but not on non-fatal recurrent myocardial

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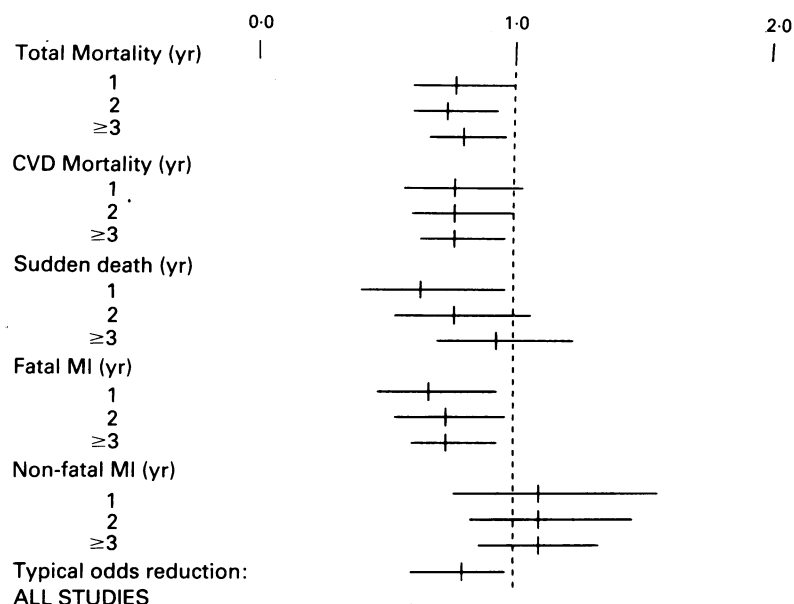


Figure 1 Effect of cardiac rehabilitation on mortality and re-infarction after myocardial infarction. Data taken from the meta-analysis of 22 trials by O'Connor *et al*<sup>14</sup> showing the point estimates of the odds reduction (vertical lines) with 95% confidence intervals (horizontal lines).

dial infarction.<sup>15</sup> These reductions in mortality compare favourably with many other currently accepted treatments in ischaemic heart disease (for example, prophylactic  $\beta$  blockade).

3.3 Dynamic training in a healthy person causes morphological changes in the heart and physiological hypertrophy may occur, with dilatation of all chambers leading to an adaptive net increase in heart size. As a consequence of these changes there is an increase in stroke volume at rest and during exercise. A trained individual will show a higher arteriovenous oxygen difference at maximal values. The catecholamine concentrations of trained individuals are lower for comparable workloads and because of a decrease in sympathetic tone, the heart rate is slower. Consequently the same cardiac work can be performed more economically because heart rate and contractility are important determinants of myocardial oxygen consumption. Slowing of the heart rate also increases the duration of diastole thus increasing myocardial perfusion time, which may have additional protective benefit.

3.4 Many studies have shown an improvement in exercise tolerance with physical training in patients with cardiovascular disease. Yet left ventricular function is often unchanged, lending support to the hypothesis that such improvement is due to peripheral adjustments.<sup>16</sup> Groups of patients undergoing sustained training for longer than one year have shown increases in stroke volume,<sup>17</sup> ejection fraction,<sup>18,19</sup> myocardial contractility, left ventricular end diastolic dimensions; posterior left ventricular wall thickness, and left ventricular mass.<sup>20,21</sup> Given the considerable individual expressions of ischaemic heart disease these factors probably inter-react to a variable degree and further study is required.

3.5 Until recently dynamic training has been the primary method applied to patients with

cardiovascular disease. However, recent work has suggested that static (resistance) training can be carried out with safety in coronary artery disease and that beneficial effects can be obtained.<sup>22</sup>

3.6 Early mobilisation after myocardial infarction and coronary artery bypass graft surgery is known to be beneficial,<sup>23,24</sup> although there continues to be debate concerning how soon after a cardiac event exercise training should begin. While some programmes start relatively vigorous exercise training within two to three weeks, most programmes introduce patients within four to six weeks of myocardial damage or cardiac surgery.

3.8 Patients of all ages should be considered for exercise training provided there is no neurological or locomotor deficiency that may hinder performance or predispose to injury. Recent work has shown a definite benefit of exercise training in patients with class II and III heart failure<sup>25</sup> and after transplantation.<sup>26</sup> To date there has been little interest in other groups that could show a similar response.

#### 4 Psychological aspects of rehabilitation

4.1 The medical and psychological outcomes for patients who have had myocardial infarction or bypass graft surgery may be independent of one another. Psychosocial problems have been shown to be common in patients with an otherwise good recovery.<sup>27</sup> Anxiety and depression have been reported in a considerable minority for at least one year after myocardial infarction and are associated with poor occupational and social adjustments.<sup>28</sup> Similar psychological disturbances are common during the early phases of recovery after cardiac surgery and have been shown to inhibit long-term outcome. Disturbed behaviour can be recognised during the stay in hospital, but it is often easiest to identify at risk patients a few weeks later when they have returned home. Those who report distress and poor general progress at this stage are more likely to have continuing problems.

4.2 Some patients minimise the seriousness of their illness by denial; this may improve short-term recovery during the acute phase but these patients may be more vulnerable during transfer or hospital discharge. It has been shown that patients' decisions and behaviour are mainly guided by their personal interpretation of illness,<sup>29</sup> and these assessments may not accord with the physician's view of the patient's state of health. Such discordance can lead to psychological disturbance and prolong the recovery phase. Persistent emotional problems are associated with poor compliance with medical advice and treatment and lead to unnecessary disability. Close relatives often suffer considerable distress and can substantially influence convalescence.

4.3 Many patients are reluctant to bother their doctors with worries about their illness and must be given the opportunity to discuss their concern about the implications of heart disease for the future. Misunderstandings can easily arise because standard booklets and

explanations do not meet the patient's own individual fears and needs. Rehabilitation programmes should provide good varied written information supplemented by individual discussion and counselling where needed. Spouses should be active in this process.

4.4 Systematic monitoring of mental state and of progress in physical activity, work, leisure, and sexual expression helps to identify emotional problems early in the rehabilitation course. Determinants include previous psychological problems or poor social adjustment, major cardiac complications, overprotective family, and those patients whose livelihoods depend on physical activity. Recognition of such problems may be more easily discovered from relatives than from the patients themselves. A proportion of such patients need access to more specialist help for stress management, depression, and behavioural treatment.

4.5 Some psychosocial benefits may be obtained by means of physical conditioning,<sup>30</sup> and education; both individual and group counselling together with the provision of stress management strategies and relaxation training are an integral part of many programmes. However, definite evidence of the effectiveness of these approaches is lacking. This lack of information partly reflects the dearth of good measures of outcome and the difficulty in setting up controlled trials in this area. The development of newer and more suitable techniques for the evaluation of the psychological effects of cardiac rehabilitation is necessary and will prove instructive.

## 5 Vocational aspects

5.1 Return to work is usually an explicit aim of cardiac rehabilitation. Whereas most patients do return to work, reports from most countries indicate that a considerable number of patients fail to return to work after myocardial infarction and bypass graft surgery. Those factors which favourably dispose to return to work are a satisfactory preinfarction work status, high educational level, social ranking, good exercise tolerance, absence of symptoms and the patient's own assessment of physical status.

5.2 Undoubtedly, many aspects of the work environment are beneficial: work gives a sense of purpose and establishes a sense of identity, it provides relationships outside the family, and is a source of obligatory activity and discipline with an opportunity to develop creative skills. These ideal concepts of the workplace, however, are not the experience of all workers and many encounter poor job satisfaction, interpersonal tensions, and communication difficulties; they cannot cope with technological advances and are disturbed by the potential of redundancy. Shift work is a particular problem for patients with cardiac disease.

5.3 Recently published guidelines<sup>31</sup> aimed at increasing the number of patients returning to work emphasise that vocational services need to be involved early in the rehabilitation process because prolonged inactivity can lead to permanent invalidism. To this end, job character-

istics should be evaluated—taking into account energy expenditure, psychological stress, risks involved, shift work, the use of heavy or vibratory equipment, and exposure to toxic substances. Good communications between the medical staff and those providing vocational counselling about medical status, exercise tolerance, and psychological outcome are essential because doctors have a major role in deciding whether or not a patient returns to work, and generally base this decision exclusively on physical criteria.

5.4 Most studies have shown that unemployment is greatest in those in the lower socioeconomic sector carrying out physically demanding jobs, and for such patients work assessment units have been shown to be of value in establishing work potential and where possible directing patients to more suitable employment. Direct contact between vocational counsellors and employers has also been shown to improve the capability to return to work.

5.5 The primary goal of such services must be to return patients to work that is compatible with their functional capability and adjustment may be helped by changing to employment or activity that is more appropriate to their current physical and psychological state. The option of giving up work is often overlooked. The impact of this aspect of vocational counselling on quality of life and longevity deserves evaluation because resumption of work is largely determined by factors such as age, severity of disease, educational level, and adequacy of pension and retirement benefits, which cardiac rehabilitation cannot influence.

## 6 Setting up a coronary rehabilitation programme

6.1 There is no ideal rehabilitation programme that will encompass the needs of every patient, and most courses evolve to suit the needs of most patients with the resources then available. The programme should offer a range of components with specific advice concerning mobilisation, work, and changes in lifestyle directed at improving prognosis (fig 2). Cardiac rehabilitation should begin as soon as possible within the hospital environment, and the clinician should identify whether the patient falls into a low or high risk group for rehabilitation, preferably with the help of a pre-discharge exercise test. Relevant family members should be involved at these early stages.

6.2 An exercise programme forms the basis around which the various other measures embodied in the rehabilitation concept can be established. Flexibility in terms of early or late entry to the programme is essential, but most patients are ready to join a supervised exercise training programme 4–8 weeks after cardiac surgery or myocardial infarction. Before formal training a symptom limited submaximal (85% maximum) exercise test is recommended. Training methods to sustain heart rates of 70–85% of that achieved at the initial exercise test are provided up to three times a week for at least 30 minutes for 6–12 weeks. Exercise for

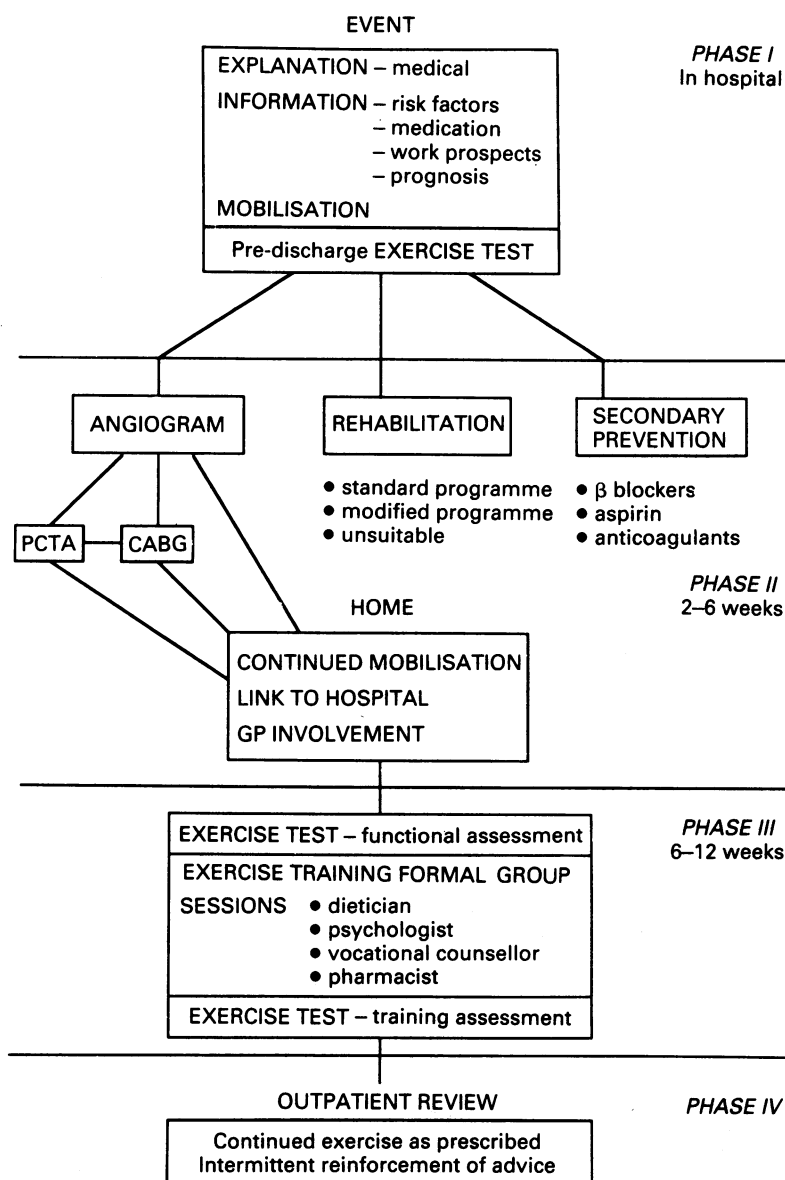


Figure 2 Scheme for patient management incorporating rehabilitation after myocardial infarction or cardiac surgery.

coronary patients should be mainly aerobic and include the use of treadmill, bicycle ergometer, steps, rowing machine, handcrank, jogging, and mini-trampoline. Some strength training can be also applied by the use of light weights. Warmup and cooldown routines are essential. On the days when formal exercise training is not taking place, walking or cycling for not less than 30 minutes is also recommended.

6.3 Training can take place in a hospital gymnasium, physiotherapy department, or a specific area within the department of cardiology, if such is available. Staff should be fully trained in cardiopulmonary resuscitation and relevant medications, and a defibrillator must be to hand. In such an environment continuous electrocardiographic monitoring will be necessary if certain high risk groups participate (table).<sup>32</sup> Community sports centres are also satisfactory areas for the provision of exercise training. A low rate of cardiac complications has been reported for such programmes.<sup>33 34</sup> Low risk patients can perform most of these exercises at home.<sup>35</sup>

6.4 A long-term programme for regular exercise should be available for all patients on completion of the formal exercise training period and a system of regular re-evaluation is recommended because with time many patients return to their previous unsatisfactory lifestyles. With the constraints on hospital resources these more long-term facilities may be more readily available from self help groups in the community. Those running hospital based programmes should, if possible, liaise with those running programmes in the community and establish a standard continuation protocol.

6.5 A nurse or physiotherapist is the most likely person to co-ordinate the rehabilitation programme. Such an individual should be familiar with all the disciplines involved in cardiac rehabilitation and be fully trained in cardiopulmonary resuscitation. The services of a dietitian, psychologist, pharmacist, vocational counsellor, and social worker should be included where appropriate. A continuous medical presence at exercise sessions or educational periods is not essential but regular attendance shows continuing interest in patient welfare, and affords a valuable opportunity to observe progress, alter treatment, and to answer questions.

6.6 Group sessions should be established in association with the formal exercise programme and should include spouses. These sessions should impart information on the nature of coronary artery disease and provide advice on a healthy lifestyle, with specific attention to smoking cessation and risk factor management in general. Work related problems must be addressed individually. Stress management and relaxation therapy should be available and spouse interviews should take place. Simple clearly written literature should be made available and discussed.

6.7 It may not be necessary for all patients to be exposed to every aspect of the rehabilitation programme. Selective use of areas where specific advice and intervention are perceived necessary can be valuable, and extended use of these facilities should be made available to the minority of patients requiring them. This may be important for women and certain ethnic groups who may find the standard exercise programme unappealing or even intimidating.

6.8 The capital costs of setting up a rehabilitation programme are relatively small, given that most Health Districts have access to adequate gymnasium facilities either within the hospital or outside. Little extra equipment is required unless it is decided to monitor the high risk individual by telemetry. Staff costs will depend on the complexity of the programme, the number of patients, and the duration of treatment. Experience from within

#### High risk patients who may require more intensive monitoring during cardiac rehabilitation

Survivors of sudden cardiac death, especially if unrelated to infarction  
Low left ventricular ejection fraction (< 35%)  
Complex ventricular arrhythmias, especially if exercise related  
Exercise induced hypotension  
Continuing effort angina  
Positive exercise test (> 2 mm ST depression)

the working party suggested that approximate running costs per patient session were £15 for a fully monitored unit in a cardiac centre, £5 for a district hospital, and £4 for a community based programme.

6.9 At present there is no nationally co-ordinated scheme for training in cardiac rehabilitation, and those interested in starting a course usually visit another centre informally or attend one of the courses held periodically at one of the established centres. Counselling is an important aspect of rehabilitation which at present is often carried out in an amateur fashion through lack of more formal training.

## 7 Current facilities in the British Isles

7.1 Cardiac rehabilitation programmes were identified by a preliminary enquiry sent by the Coronary Prevention Group to 268 cardiac care/intensive care units in the United Kingdom and Republic of Ireland listed in the *Directory of Emergency and Special Care Units*. This was followed by a more detailed questionnaire sent in mid-1989 to the individual (usually the consultant, nurse, or physiotherapist) identified as being in charge of the programme. A total of 91 established outpatient programmes were identified: 88 in hospitals (87 in the United Kingdom and one in the Republic of Ireland), and three in the community. These figures show that considerably less than half the Health Districts in the British Isles have an established rehabilitation programme.

7.2 Although some courses had been established for almost 20 years, an increasing number of programmes had been established in the past five years, 32 of them in the previous two years (fig 3). The size of these programmes varied considerably; the numbers of patients completing outpatient cardiac rehabilitation in the year January to December 1988 were as follows: less than 50 patients/year, 14 centres; 50–100 patients/year, 27 centres; 100–200 patients/year, 17 centres; 200–500 patients/year, 14 centres. Most centres treated patients after both myocardial infarction and coronary artery bypass surgery. Twenty two centres also catered for patients after valve surgery or transplant; 14 of these were centres for cardiac surgery.

7.3 Programmes at 50 centres had been started at the request of a consultant; the remainder were requested by a nurse or physiotherapist. There was continuing involvement of the consultant in 61 hospitals; a

cardiologist was involved in only 27 of the 61 programmes.

7.4 Physiotherapists were involved in 75 programmes, dietitians in 65, nurses in 37, occupational therapists in 19, psychologists in 20, social workers in eight, general practitioners in six and employment advisers in one programme. Sessional commitments for all disciplines were usually 1–2 hours, with physiotherapists involved each week and others attending once or twice a month.

7.5 Most programmes (75) defined some exclusion criteria. There was an age limit in 47. No centres excluded women, but several recorded problems for women who attended. These included family commitments, difficulties with transport, and embarrassment in sessions with a predominance of men. The commonest cardiac conditions to be excluded were arrhythmias, cardiac failure, and angina.

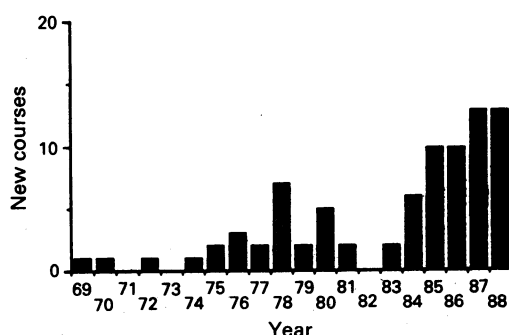
7.6 Most courses organised rehabilitation in groups. Patients generally started within four weeks of myocardial infarction, but a little later after cardiac surgery, and courses lasted 4–12 weeks. Sessions usually lasted 1–2 hours and were held 1–6 times per week. Five centres included specific relaxation sessions. Sixty four programmes included counselling in the sessions, usually with the spouse. In addition 39 centres had a local self help group; in 24 this was based in the community and in 15 in the hospital.

7.7 Formal exercise testing was carried out as a routine in only 28 centres before and only 17 after cardiac rehabilitation, though most (79) carried out exercise testing in selected patients.

7.8 Staff trained in cardiopulmonary resuscitation were present during sessions at all but two centres, and resuscitation equipment available in all but four. There was medical supervision during sessions in 58 centres; in 29 this was a doctor and in 35 a nurse. All but six centres undertook some form of patient monitoring; in most this was simply pulse or blood pressure, but 10 had full electrocardiographic monitoring. Only 44 centres reported that they had experienced any incidents during an exercise session. Serious reactions were reported from only seven centres in the past year; one myocardial infarction, five cardiac arrests, and two deaths (one centre had two incidents).

7.9 The drop-out rate was estimated to be less than 10% in most centres (60 out of 76 responding). Motivation, transport, medical problems, and interference with returning to work were all regarded as important reasons for non-attendance.

Figure 3 Number of new cardiac rehabilitation programmes established each year.



## 8 Comment on current provision

8.1 There is a striking lack of cardiac rehabilitation facilities in the British Isles at present, with large areas of the country offering no facilities at all. As a result the full benefit of the advances in medical and surgical treatment are not being realised. There is, however, a growing interest at "grass roots" level which may be stimulated by the recommendations made in the recent Royal College of Physicians report on Medical Aspects of Exercise.<sup>36</sup> In a recent survey by the Coronary Prevention

Group, about one third of Health Districts wished to establish a rehabilitation programme, and only one third expressed no interest.

8.2 The level of direct involvement by cardiologists in rehabilitation programmes in the British Isles is very low, with less than one third of established courses retaining the support of the local cardiologist. It is perhaps surprising that although most cardiologists make extensive use of exercise testing after myocardial infarction, so few use this to aid exercise training. This may reflect the current emphasis in training on "high tech" procedures rather than a more holistic approach to patient care. Nevertheless, the cardiologist will remain the most appropriate individual to co-ordinate the activities involved in cardiac rehabilitation in most district hospitals.

8.3 The role of cardiac rehabilitation after myocardial infarction and coronary artery bypass graft surgery is generally established, but patients also benefit after cardiac transplantation or valve surgery. Rehabilitation may also be beneficial for patients with angina pectoris who have not yet sustained a myocardial infarction, patients with class II or III heart failure, after angioplasty, physiological pacemaker implantation, and prosthetic valve surgery; and in younger patients after correction of congenital heart lesions. The disparate nature of these groups emphasises the importance of tailoring programmes to individual patient needs; congenital heart disease patients and prosthetic valve recipients may well benefit from the non-exercise elements of cardiac rehabilitation.

8.4 Many programmes tend only to include patients up to the age of 65 and it is now generally agreed that there should be no specific age limit; elements of the rehabilitation programme applicable to patients in the older age groups should be made available.

8.5 The lower incidence of coronary heart disease in women has led to fewer female patients being included in programmes. Though a training response similar to that in men can be obtained, drop-out rates are high both in the British Isles<sup>37</sup> and the United States.<sup>38</sup> Therefore, female patients need to be encouraged to participate in rehabilitation particularly because the psychological and vocational aspects of cardiac disease in women has attracted insufficient attention.

8.6 Perhaps because of the pressures under which many programmes operate, little attention is given to the non-attender. Such patients frequently have social or psychological problems that place them in a high risk group. The rehabilitation co-ordinator is probably best placed to identify problems that may prevent patients attending and bring them to the attention of the clinician concerned.

8.7 If cardiac rehabilitation is to fulfil a long-term preventive function there must be more emphasis on continuing exercise and risk factor modification as seen in North America and Europe. This is only feasible on any scale in the British Isles with self-help groups, often supported by charities such as the Chest Heart and

Stroke Association. At present these facilities exist in less than 20% of health districts. Medical risk factors such as hypertension and hyperlipidaemia are the responsibility of the primary health care team.

## 9 Recommendations

9.1 Every major district hospital that treats patients with heart disease should provide a cardiac rehabilitation service; at present too few do.

9.2 The programme should be multidisciplinary and usually exercise based, depending on the resources available. A local co-ordinator is essential.

9.3 The expertise available for a comprehensive programme is available in most district and major cardiothoracic centres, but requires consultant leadership, most appropriately by a cardiologist.

9.4 There is a continued need for research into the evaluation of not only the physiological response, but also the social and psychological aspects of rehabilitation.

9.5 The role of vocational rehabilitation in recovery needs greater recognition.

9.6 The special problems of women and children and certain ethnic groups need to be addressed.

9.7 Rehabilitation should be tailored to the individual needs of patients and special group requirements. Arrhythmia monitoring is necessary for high risk patients.

9.8 Individual programmes should evaluate their outcome, and a standard format of audit could be agreed nationally to allow comparison.

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